



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

March 5, 2001

Colonel Ralph H. Graves
Corps of Engineers (COE)
Seattle District
P.O. Box 3755
Seattle, WA 98124-2255

Re: Endangered Species Act Section 7 Consultation Biological Opinion on the Maersk Sealand Pier Extension Project (NMFS No. WSB-00-481) and Essential Fish Habitat Consultation.

Dear Colonel Graves:

The attached document transmits the National Marine Fisheries Service's (NMFS) Biological Opinion (BO) on the proposed Maersk Sealand Pier Extension project in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*) and Public Law 104-267, Sustainable Fisheries Act of 1996, which amended the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The National Marine Fisheries Service (NMFS) determined that the proposed action is likely to adversely affect Threatened Puget Sound chinook salmon (*Oncorhynchus tshawytscha*) which is under NMFS' jurisdiction. Formal consultation was initiated for this project on December 14, 2000.

This BO reflects formal consultation and an analysis of effects covering the Threatened Puget Sound chinook salmon utilizing Commencement Bay and the Puyallup River, Washington. The BO is based on information provided in the Biological Assessment (BAs) sent to NMFS by the COE and Port of Tacoma, and additional information transmitted via telephone conversations, mail and e-mail with the project applicant. A complete administrative record of this consultation is on file at the Washington State Habitat Branch Office.

The NMFS concludes that implementation of the proposed project is not likely to jeopardize the continued existence of Threatened Puget Sound chinook salmon or result in destruction or adverse modification of their critical habitat. In your review, please note that the incidental take statement, which includes reasonable and prudent measures and terms and conditions, was designed to minimize take.

If you have any questions, please contact Thom Hooper of the Washington State Habitat Branch Office at (360) 753-9453.

Sincerely,

Donna Darm
Acting Regional Administrator

Enclosure



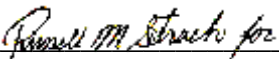
Endangered Species Act - Section 7 Consultation
and
Essential Fish Habitat Consultation

Biological Opinion

Maersk Sealand Pier Extension Project WSB-00-481

Action Agency: U. S. Army Corps of Engineers

Consultation National Marine Fisheries Service,
Conducted by: Northwest Region

Approved 
Michael R. Crouse
Assistant Regional Administrator

Date Issued: March 5, 2001

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I. BACKGROUND AND DESCRIPTION OF THE PROPOSED ACTION

A. Background/Consultation History

On October 6, 2000, the National Marine Fisheries Service (NMFS) received a draft Biological Assessment (BA) for the Port of Tacoma's proposed 600-foot extension to the Maersk Sealand pier in the Sitcum Waterway, Tacoma, Washington from the U.S. Army Corps of Engineers (ACOE), Seattle District. NMFS reviewed the draft BA and on November 2, 2000, responded to the ACOE with a letter asking for additional information necessary to initiate formal consultation. The Port of Tacoma hand delivered a cover letter along with numerous attachments in response to NMFS' November 2nd letter. NMFS responded to the Port of Tacoma's November 27th materials with an email on December 4, 2000 asking clarifying questions. On December 6th the Port responded by email. NMFS met with the Port of Tacoma and their consultant on December 7, 2000 to go over the questions from NMFS' December 4 email and the Ports December 6th response. After this meeting, NMFS, along with a Port representative, then toured the pier expansion site and the proposed mitigation site. During the December 7th meeting, NMFS detailed concerns about the initial mitigation proposal. These concerns were discussed in more detail with the Port during the week of December 11th. Formal consultation was initiated on December 15, 2000.

The purpose of this Biological Opinion (BO) is to determine whether the proposed action is likely to jeopardize the continued existence of the Puget Sound chinook salmon (*Oncorhynchus tshawytscha*), or result in the destruction or adverse modification of critical habitat.

NMFS reviewed the following information and engaged in the following steps to reach its determination and prepare this BO:

- the available BA authored by Pacific International Engineering (PIE, 2000) and supplemental information provided by the Port and PIE as described above;

- a December 7, 2000 site tour of the Maersk Sealand pier with a Port of Tacoma representative;

- a November 2, 2000 letter from NMFS to ACOE identifying additional information needs;

- a December 4, 2000 response to the Port of Tacoma's November 27 materials provided in response to NMFS' November 2nd letter;

- review of additional materials researched by NMFS, or supplied by the Port, ACOE, USFWS and the State of Washington;

- a December 4, 2000 meeting with the Washington Department of Fish and Wildlife's Habitat Biologists, and numerous follow-up phone conversations;

a thorough review of 15 years of Puyallup Tribe of Indians beach seine data in Commencement Bay and the development of a spreadsheet summarizing the data in terms of catch per unit effort by waterway;

Additional materials supplied by the Port of Tacoma as addenda to responses described above;

E-mailed page describing the size of rock to be used in the expanded mitigation action by the Port of Tacoma;

Conference call between the Corps of Engineers, U.S. Fish and Wildlife Service, the Port of Tacoma and NMFS (December 20, 2000);

Updated mitigation plan, hand delivered, December 20, 2000;

Conference call between the Corps of Engineers, U.S. Fish and Wildlife Service, the Port of Tacoma and NMFS (January 5, 2001) to discuss “Reasonable and Prudent Alternatives” options. The Port agreed in concept to an RPA which involved expanding an existing wetland adjacent to the Puyallup River;

Port of Tacoma phone call on January 11, 2001. The Port informed NMFS that they wanted to modify their action to include the RPA discussed during a conference call on January 5th;

Fax received from Pacific International Engineering, late on Friday January 12, 2001. This fax transmitted a conceptual plan for the expansion of the “Gog-Le-Hi-Te wetland adjacent to the Puyallup River;

Conference call on January 16, 2001 between the Corps of Engineers, U.S. Fish and Wildlife Service, the Port of Tacoma and NMFS to discuss the conceptual plan to expand the Gog-Le-Hi-Te wetland that was received on the previous business day (January 12th). NMFS informed the Port of Tacoma that a letter from them stating they are modifying their action to include the Gog-Le-Hi-Te wetland expansion will be necessary;

Conference call on January 17, 2001 between the Corps of Engineers, U.S. Fish and Wildlife Service, the Port of Tacoma, NMFS, Dr. Ron Thom (Battelle NW Marine Lab, Sequim, WA), and Charles “Si” Simenstad (School of Aquatic and Fishery Science, University of Washington) to discuss ecological objectives for the expansion of the Gog-Le-Hi-Te wetland;

Fax received on January 24, 2001 from the Port of Tacoma. The revised conceptual plan for the mitigation action at the Gog-Le-Hi-Te site. 12 pages;

Conference call on January 29, 2001 between the Corps of Engineers, U.S. Fish and Wildlife Service, the Port of Tacoma, and NMFS regarding Port proposed alternatives to the action at the Gog-Le-Hi-Te site;

Conference call on January 30, 2001 between the Corps of Engineers, U.S. Fish and Wildlife Service, the Port of Tacoma, and NMFS regarding the action at the Gog-Le-Hi-Te site and the conceptual plan faxed on January 24, 2001.

In addition to the above, other information was informally transferred between NMFS, USFWS, ACOE, the Port of Tacoma, and the Port's consultant (Pacific International Engineering) during the preparation of this biological opinion.

B. Description of the Proposed Action

The term "action area" means "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." The action area includes the adjacent uplands, intertidal and subtidal shoreline from the Gog-Le-Hi-Te wetland, just upstream of the Lincoln Avenue bridge, in the lower Puyallup River, north to Browns Point and northwest to Point Defiance. This area encompasses the lower Puyallup River, all of the waterways north and south of the river, and the shorelines out to Browns Point and Point Defiance.

The Port of Tacoma proposes to drive 344 concrete piles and 134 steel piles to support a 730-foot pier extension on the south side of the Sitcum Waterway. The extension will be located on the western end of the existing pier structure. The project also includes the construction of two concrete pile-supported truck accessways; one at the western end of the proposed pier extension and one at the eastern end of the existing pier.

According to the Biological Assessment, prepared by Pacific International Engineering (PIE), for the Port of Tacoma, 2000: Construction activities include preparation of the north and south ends of the pier for expansion, removal of the northern catwalk and mooring dolphin, pile driving, construction of the pier deck, and installation of crane rails. Selective demolition would be conducted at each end of the existing pier, concrete bullrail and pile cap for integration of the new structures. The work will be conducted from the top of the existing deck using jack hammers, backhoes and dump trucks to remove, gather and transfer material from the site to a disposal site or recycling center. Debris associated with these activities will be captured and not allowed to enter the Sitcum Waterway.

In correspondence received from the Port on November 27, 2000, NMFS learned that a total of 344 pre-cast concrete piles and 134 steel piles will be driven using barge-mounted cranes "common to waterfront construction." Piles will arrive to the site by barges, and cranes will loft each pile and drive it into the final position. Pile driving hammers are proposed to advance the piles into the substrata. In addition, some steel piles that are placed near the top of the shoreline bank may be installed using crawler cranes located on the uplands. Piles will be driven through the existing riprap. Prior to pile driving, placement of 2 ½ inch minus rock will be placed over the riprap at the outer 100 feet of shoreline (as described below).

The Port has proposed three additional projects intended to address the overall environmental effects on the ecological functions that support juvenile chinook. The first project involves the western end of the new pier extension. The intertidal zone here currently consists of riprap placed at a two to one slope throughout the entire profile of the intertidal and deep into the subtidal. This riprap will receive 2 ½ inch "minus"

angular rock to fill the interstitial voids and improve the habitat for the production of epibenthic prey for juvenile chinook and other juvenile salmon.

The second project involves an upland peninsula site located along the north side of the Hylebos Waterway, immediately bayward of East 11th Street. This site is owned by the Puyallup Tribe of Indians and is adjacent to Tribal land that has been designated for habitat conservancy and restoration. Currently this peninsula separates an extensive area of existing mudflat from the Hylebos Waterway. Elevations at the peninsula range from approximately +11.8 feet to +18 feet MLLW. The minimization measure proposed here is converting 0.37 acres of the upland peninsula into mid- to upper intertidal habitat. Intertidal habitat would be developed by excavating upland gradually down to the upper elevation of the mudflat on the north. The intertidal profile created would extend from above Ordinary High Water down through MHHW of +11.8 feet to +6 feet MLLW to allow blending of contours with existing habitat. The slope of this new intertidal profile would be approximately eleven to one. This proposed alteration to the existing baseline conditions will afford some additional shallow, upper intertidal habitat, gently sloped, to provide some increased refuge and feeding capacity for salmonids.

The third project involves expanding an existing mitigation site on the Puyallup River. This site is known as the Gog-Le-Hi-Te wetland mitigation site. The existing wetland was created as a mitigation requirement for a past Port of Tacoma development action per section 404 of the Clean Water Act. A portion of the upland area at this site will be converted to high marsh wetland and connected to the existing wetland to provide additional rearing habitat and functions for juvenile chinook. A minimum of 0.39 acres at approximately +12.0 feet MLLW will be created. Also at this site, riparian trees will be planted on the adjacent uplands to provide additional ecological functions for juvenile chinook. A complicating feature about this site is that it is an old City of Tacoma garbage landfill site. Buried here are unknown relics of past domestic garbage. Some or all of this refuse will have to be removed to create this additional wetland area.

The proposed pier extension and truck accessways would connect to the existing shoreline and existing pier on the south side of the Sitcum Waterway, altering rearing and migration conditions along this shore for juvenile chinook salmon. Steel and concrete piles will be driven through the existing riprap along the nearshore. Concrete piles will be driven in the deeper portions of the waterway. The presence of these piles will also cause shading effects on the nearshore and will alter habitat structure.

Summary of Conservation Measures Proposed by the Action Agency

The proposed action by the Port of Tacoma is being conducted with the following conservation measures:

- Timing restrictions specifying that in-water work must occur when juvenile salmonids are absent or in extremely low numbers. The Port extended previous salmonid work closure window by fifteen days. The Port proposes no in-water work from 15 March to June 30.
- Follow conditions of HPA and Section 401 water quality certification.
- Using larger diameter piles to reduce the number of piles needed to support the pier.

- Preventing all construction materials from entering the Sitcum Waterway
- Converting 0.37 acres of upland habitat in the Hylebos Waterway to an upper intertidal beach profile, to minimize impacts from the over-water pier.
- Designing the truck ingress and egress pathways using minimum practical design radius to slightly reduce shading effects on intertidal and subtidal habitat.
- During the construction at the mitigation beach in the Hylebos, and the high marsh wetland in the Gog-Le-Hi-Te wetland, several measures will be used to reduce construction impacts: i) removal of any contaminated material that is encountered during the upland excavation of the site; ii) excavate only when tidal elevations are below +6 feet MLLW (Hylebos site only); iii) boom the construction site to contain any material that may float away; iv) install silt fencing and/or hay bales to control erosion from the upland edges of the excavation, stockpiling and staging areas, and haul roads.
- Follow water quality standards and procedures that limit the impact of turbidity and stormwater runoff (401 Certification issued by the Department of Ecology, 12/22/2000).
- Monitoring of epibenthic production and salmonid use to ensure the Port's proposed mitigation action provides the functions described in the Mitigation Plan (Pacific International Engineering 2000).
- Contingency Planning procedures to implement corrective actions if intended habitat functions are not provided at the Port's Mitigation Site (Pacific International Engineering 2000).
- The existing riprap at the bayward end of the new pier extension (outer 100 feet) will receive select 2 ½ inch "minus" rock to improve the characteristics of the substrate for production of epibenthic prey for juvenile salmonids, chinook and chum in particular.
- Pilings will be steel or concrete instead of treated wood.
- All construction debris shall be properly disposed of on land so that it cannot enter the waterway or cause water quality degradation to state waters.
- Expanding the Gog-Le-Hi-Te Wetland to increase aquatic-based primary and secondary production, the export of detritus and salmonid prey, and potentially increase salmonid residence time in the wetland.

II. STATUS OF THE SPECIES AND CRITICAL HABITAT

A. Species Information

Puget Sound chinook salmon was listed on March 24, 1999 (64 Fed. Reg. 14307). Critical habitat was designated on February 16, 2000 (65 Fed. Reg. 7764). The species status review identified the high level of hatchery production which masks severe population depression in the ESU, as well as severe degradation of spawning and rearing habitats, and restriction or elimination of migratory access as causes for the range-wide decline in Puget Sound chinook salmon stocks (NMFS, 1998a, and 1998b).

Chinook salmon of this listed ESU that are likely to be adversely affected by the proposed action are present in Commencement Bay, hence within the action area (Water Resource Inventory Areas (WRIA) 10 & 12). Commencement Bay has been documented as a rearing and migration corridor, with natural spawning in the Puyallup River and its tributaries (SASSI, 1992). Beach seine and townet samples have been collected over the years (PIE 1999; Duker et al, 1989; Simenstad et al, 1985), providing valuable information on the timing and presence of juvenile salmonids. Many of these sampling activities were conducted in the Milwaukee and across the mouth of the Sitcum Waterway, in the Blair and the Hylebos Waterways. Table 1 summarizes this data comparing three Waterways - the Milwaukee, Blair and Hylebos.

Juvenile chinook, migrating through the Puyallup River delta and Commencement Bay originate from three basic stocks (SASSI, 1992): White (Puyallup) River spring; White River summer/fall; and Puyallup River fall. There are differences among these stocks both in run and spawning timing and in the location of spawning grounds (SASSI, 1992). As described in numerous scientific papers about juvenile salmon in tidal floodplains and estuaries (e.g., Healey 1982, 1991; Macdonald *et al.* 1987, 1988; Myers *et al.* 1998; Simenstad *et al.* 1982; Tschaplinski 1982, 1987), the early life-history phase between freshwater and the ocean can often be very important in determining adult returns. Juvenile salmon use estuaries for physiological adaptation, foraging, and refuge. As described by Simenstad (2000), some aspects of the early life history of juveniles in estuaries are obligatory, such as the physiological requirement to adapt from freshwater to saltwater. Other attributes of estuaries, from an evolutionary standpoint, promote behaviors that enhance survival, such as minimizing mortality due to predation by seeking estuarine shallow-water, vegetation (e.g., eelgrass meadows), turbid habitats; and growth by foraging on the typically high and concentrated densities of potential food organisms available along the shallow nearshore in estuaries (e.g., Meyer 1979; Miller 1993; Miller and Simenstad 1997; Simenstad 1993; Simenstad *et al.* 1982; Myers and Horton 1982; Pearce *et al.* 1982; Shepard 1981; Thom 1987). Generalized habitat requirements of juvenile chinook in estuaries include shallow-water, typically low gradient habitats with fine, unconsolidated substrates and

Table 1. Summary of beach seine data; comparing total numbers, sample size, and catch per unit effort (CPUE) in the Milwaukee (near the project site), the Blair, and the Hylebos Waterways (mitigation site).

	80			81			82			83			84			85			86			87			91			92			93			94			95		
	M	B	H	M	B	H	M	B	H	M	B	H	M	B	H	M	B	H	M	B	H	M	B	H	M	B	H	M	B	H	M	B	H	M	B	H			
Totals	340	129	250	44	87	56	1378	47	96	1338	23	53	347	87	72	534	74	59	75	47	155	2	16	24	62	19	6	2	12	3	116	6	4	466	0	27	12	1	0
Samples	n=11	n=27	n=72	n=11	n=48	n=64	n=44	n=12	n=38	n=47	n=11	n=36	n=30	n=17	n=42	n=18	n=10	n=20	n=22	n=15	n=28	n=7	n=12	n=22	n=17	n=9	n=17	n=7	n=6	n=10	n=7	n=6	n=6	n=5	n=8	n=1	n=2		
CPUE	30.9	4.8	3.5	4.0	1.8	0.9	31.3	3.9	2.5	28.5	2.1	1.5	11.6	5.1	1.7	29.7	7.4	3.0	3.4	3.1	5.5	0.3	1.3	1.1	3.6	2.1	0.4	0.3	2	0.3	16.6	1	0.7	93	****	3.4	12.0	0.5	*****

Table compiled by NMFS / December, 2000.

M = Milwaukee Data (all sites composited)

B = Blair Data (all sites composited)

H = Hylebos Data (all sites composited)

Data Source: Puyallup Tribe of Indians Beach Seine Data Summary, 1980 - 1995

Prepared for the Port of Tacoma and Puyallup Tribe of Indians by Pacific International Engineering

aquatic, emergent vegetation; areas of low current and wave energy; and concentrations of small, epibenthic invertebrates (Simenstad *et al.* 1985).

Duker *et al.* (1989), described the likely use of the Puyallup delta and Commencement Bay estuary by juvenile chinook in its current, highly modified state. Smaller and more nearshore-dependent ocean-type chinook enter the estuary as early as February and continue to do so typically into early to mid-summer (PIE 1999). The presence of these later fish is masked with the arrival of mainly hatchery-origin chinook in mid-May (Duker *et al.* 1989). It is these smaller chinook juveniles that have had the greatest challenges in making the critical life-history transition from freshwater to salt because of the significant modifications to the Puyallup River and the estuarine shoreline (Simenstad 2000).

Healey (1982) describes the use of the shoreline by young chinook as one of extreme dependence for feeding, rearing and refuge. Movement offshore occurs as the individuals increase in size. It has been postulated that the hatchery fish have less of a preference for the shoreline; instead they use all available areas. (Duker *et al.*, 1989). The fish caught in these studies were generally large enough to have made the shift to feeding on pelagic prey and therefore less dependent on the nearshore for food (Duker *et al.* 1989; Simenstad 2000).

The Puyallup Tribe of Indians conducted beach seine sampling between the years 1980 - 1995 (however, no data was available in 1988, 1989, and 1990). They found heavy use of the Milwaukee Waterway by chinook (Pacific International Engineering, 1999). The Milwaukee is the first Waterway to the north of the Puyallup River, and is adjacent to the Sitcum Waterway, the site of the proposed pier extension. An analysis of the data by NMFS comparing just three waterways (Milwaukee, Blair, and Hylebos) showed that the higher catches were in the Milwaukee/Sitcum Waterways and the lowest catches were in the Hylebos Waterway (Table 1).¹

The Puyallup Tribe study showed high relative abundance of juvenile chinook along the inner Commencement Bay shoreline early in the outmigration, prior to release of hatchery fish. The beach seine sampling between the years 1980-1995 and tow net sampling in the early 1980's (Duker *et al.* 1989) found juvenile chinook along the Milwaukee, Blair and Hylebos shorelines from the beginning of March, when more intense sampling began, to the middle of September, when sampling ceased (PIE, 1999). The last occurrence of juvenile chinook corresponded with the latest date of sampling. While the numbers of chinook reported in September were very low, it is possible that juvenile chinook reside in Commencement Bay throughout the entire winter. The data showed that the peak of the juvenile chinook out-migration, along the inner Commencement Bay nearshore, is past by the end of June. However, NMFS review of the Puyallup beach seine data-set, indicated that a fair abundance of chinook juveniles were being caught well into August.

¹Source of Data: Puyallup Tribe of Indians 1980 - 1995 Beach Seine Data; and from Duker *et al.* 1983.

B. Habitat Conditions

Habitat alterations and subsequent availability are clearly understood to impose an upper limit on the production of naturally spawning populations of salmon. The National Research Council Committee on Protection and Management of Pacific Northwest Anadromous Salmonids identified habitat problems as a primary cause of declines in wild salmon runs (NRCC, 1996). Some of the habitat impacts identified were the fragmentation and loss of available spawning and rearing habitat, migration delays, degradation of water quality, removal of riparian vegetation, decline of habitat complexity, alteration of streamflows and streambank and channel morphology, alteration of ambient stream water temperatures, sedimentation, and loss of spawning gravel, pool habitat and large woody debris (NMFS, 1998a, NRCC, 1996, Bishop and Morgan, 1996). Other factors such as increased impervious area, upland land use practices and polluted runoff, contaminants in coastal wetlands and estuaries, shoreline modifications, and dredge spoil disposal have also been identified as habitat problems contributing to the decline of chinook salmon (PFMC, 1995, WSGSRO, 1999).

Commencement Bay is an estuarine embayment adjacent to the deep, fjord system of south-central Puget Sound. The waters are deep throughout the entire bay, ranging from 73.8 feet at the head to 531.7 feet at the entrance (David Evans and Assoc., Inc., 1991 in COE *et al*, 1993). The waters shoal abruptly at the head of the bay to the remnant mudflats, which are exposed at low water. A significant input of freshwater and sediment load to the bay occurs from the Puyallup River, and to a much less extent from Hylebos and Wapato creeks. Between 37 and 76 hectares of intertidal mudflats remain and are scattered throughout the waterways and inner parts of the bay.

Commencement Bay is generally defined as the geographic region of south Puget Sound in Washington State extending from Brown's Point to Point Defiance. Besides the marine water influence from Puget Sound, there is significant freshwater input into the bay from the inlands to the southeast. The Hylebos and Wapato Creeks and the Puyallup River all contribute considerable flows to the bay and simultaneously a proportionate amount of sediment load. Historically, emergent marsh vegetation covered between 2,471 and 2539 acres of the Puyallup delta (David Evans and Associates, 1991). Today, less than one percent of this once vast marsh remains. The lower Puyallup River, its delta, and Commencement Bay, is one of the most modified and stressed natural systems in the Pacific Northwest. As such, the use, and life-support opportunities afforded juvenile chinook and other salmonids by the lower river and estuary have forever been altered. Despite the abject degradation of the Puyallup River delta and Commencement Bay estuary, fish and wildlife, especially anadromous fishes and migratory waterfowl, are still reliant upon the remaining habitat functions.

Juvenile salmon utilization of the historical Puyallup River delta/Commencement Bay estuary was likely prolonged and widely dispersed (Simenstad, 2000). In the once extensive tidal-freshwater flood plain, considerable side-channel, relict oxbow, and other low-energy environments provided extensive opportunities for river-type chinook. Within the freshwater-brackish or oligohaline reach of the estuary, ocean-type chinook had the opportunity to occupy low-energy side-channel and marsh habitats to allow the requisite osmoregulatory changes necessary to survive the saltwater phase of their early life-history. Also, chinook and other types of salmon (pink and chum) had considerable opportunities to

move into expansive emergent marshes (described below) of the delta at high tides, where they could reside in complex dendritic tidal channel systems. As is evident in data from sampling efforts by Duker *et al.* (1989) and the Puyallup Tribe of Indians (Pacific International Engineering, 1999), juvenile subyearling salmon fry and small fingerlings likely would have stayed within the influence of the river's buoyant turbidity plume or in shallow water. The ocean-type chinook enter the estuary earlier, and at a smaller size, than the river-type and hatchery origin chinook.

In addition to the expanse of transitional habitats providing opportunity for physiological adaptation and refuge from predators, the historical habitats of the Puyallup delta/Commencement Bay estuary would have produced an abundance and diversity of food organisms favored by juvenile salmonids. The tidal floodplain's freshwater wetlands, side-channels, and riparian complexes would have generated a multitude of insects - both as aquatic larvae and pupae, and as adults. These are prominent components of juvenile salmon diets as they emigrate from fresh to brackish water. Shallow-water, vegetated tidal-freshwater, brackish, and oligohaline marshes, and to a lesser degree mudflats, are notable for high production of dipteran flies, aphids, and other insects characteristic of salmon diets prior to entering more euryhaline habitats (Levy and Northcote 1982). In the more euryhaline marshes and mudflats, benthic and epibenthic crustaceans were more important prey of juvenile salmon. Certain taxa of gammarid amphipods, harpacticoid copepods, isopods and mysids - often preferred prey - are characteristic of marsh vegetation, fine sediments, and tidal channels. Only as salmon move to more open water of the bay as larger smolts do they rely on planktonic prey. However, studies by Simenstad *et al.* (1985) showed that juvenile chinook continue to feed upon surface drift insects or neustonic drift, exported by the Puyallup River even when they were in open waters of the bay.

The proposed action would occur within designated critical habitat for Puget Sound chinook salmon. In the case of the Puget Sound evolutionarily significant unit (ESU), due to the unique combination of geographic features, proximity to a large number of rivers and streams supporting chinook salmon, and a wide range of human activities occurring within Puget Sound, NMFS believes that it is necessary to designate critical habitat in this estuarine area (63 Fed. Reg. 11510, March 9, 1998). NMFS has identified the current freshwater, estuarine, and marine range of Puget Sound designated critical habitat to encompass all essential habitat features adequate to ensure the species' conservation (65 Fed. Reg. 7764, February 16, 2000). NMFS recognizes that estuarine habitats are important for rearing and migrating chinook salmon, and has included them in the designation for critical habitat (63 Fed. Reg. 11510, March 9, 1998).

NMFS believes that adopting a more inclusive, watershed-based description of critical habitat is appropriate because it: (1) recognizes the species' use of diverse habitats and underscores the need to account for all of the habitat types supporting the species' freshwater and estuarine life stages, from small headwater streams to migration corridors and estuarine rearing areas; (2) takes into account the natural variability in habitat use (e.g., some streams may have fish present only in years with plentiful rainfall) that makes precise mapping difficult; and (3) reinforces the important linkage between aquatic areas and adjacent riparian/upslope areas (63 Fed. Reg. 11511, March 9, 1998).

Essential features of chinook salmon critical habitat include adequate substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space and safe passage conditions (Simenstad *et al*, 1982, NRCC, 1996, Palmisano *et al*, 1993, Gregory and Bisson, 1997, Spence *et al*, 1996). NMFS has identified a limited number of specific activities that may require special management considerations for freshwater, estuarine, and marine life stages of chinook salmon habitat, including land management and dredge and fill activities (65 Fed Reg. 7764, February 16, 2000).

Losses of wetlands, tidal sloughs, and estuaries in heavily urbanized or industrialized river basins have been extensive; in some areas of Puget Sound, greater than 95 percent of estuaries and coastal wetland habitats have been eliminated since the 19th century (Sherwood *et al*, 1990, Simenstad *et al*, 1993). At the head of Commencement Bay, the historic scenario described above has been eliminated by the significant habitat modifications that have occurred, both in the Puyallup River and in the bay. The vast expanse of saltmarsh, mudflats, and tidal channels, that is evident from historical maps and aerial photographs, has been almost totally eliminated by dredging and filling over the last 100 years (U.S. ACOE *et al*, 1993, WDNR 2000). Along the southern shoreline, a variety of industrial, commercial, and recreational activities occur. A number of man-made features, such as roads supported by riprap bulkheads, a marina basin, and the 2000 ft-long slag breakwater peninsula stem from those activities (Parametrix, 2000).

III. EVALUTATING THE PROPOSED ACTIONS

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined by 50 CFR Part 402 (the consultation regulations). NMFS must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify critical habitat. This analysis involves the initial steps of: (1) defining the biological requirements and current status of the listed species; and (2) evaluating the relevance of the environmental baseline to the species' current status.

Subsequently, NMFS evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NMFS must consider the estimated level of injury or mortality attributable to: (1) collective effects of the proposed or continuing action; (2) the environmental baseline; and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed salmon's life stages that occur beyond the action area. If NMFS finds that the action is likely to jeopardize, NMFS must identify reasonable and prudent alternatives for the action.

Furthermore, NMFS evaluates whether the action, directly or indirectly, is likely to destroy or adversely modify the listed species' designated critical habitat. NMFS must determine whether habitat modifications appreciably diminish the value of critical habitat for both survival and recovery of the listed species. NMFS identifies those effects of the action that impair the function of any essential element of critical habitat. NMFS then considers whether such impairment appreciably diminishes the

habitat's value for the species' survival and recovery. If NMFS concludes that the action will adversely modify critical habitat it must identify any reasonable and prudent measures available.

Guidance for making determinations on the issue of jeopardy and adverse modification of habitat are contained in *The Habitat Approach, Implementation of Section 7 of the Endangered Species Act for Actions Affecting the Habitat of Pacific Anadromous Salmonids*, August 1999. (Appendix I)

For the proposed action, NMFS' jeopardy analysis considers direct and/or indirect mortality of fish attributable to the action. For this specific action, NMFS' critical habitat analysis considers the extent to which the proposed action impairs the function of essential elements necessary for rearing, refugia and migration of the Puget Sound chinook salmon in consideration of the existing environmental baseline.

A. Environmental Baseline

The environmental baseline represents the current basal set of conditions to which the effects of the proposed action are then added. The term "environmental baseline" means "the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 C.F.R. § 402.02)."

NMFS is familiar with numerous activities that influence the current environmental baseline conditions in Commencement Bay including expanding urban development, railroads, shipping, logging, agriculture, and other industries. The present port area of Tacoma was created during the late 1800s and early part of the 1900s by filling the tidal marsh that had developed on the shelf of the Puyallup River delta. Continuing habitat alterations such as dredging, relocation, and dyking of the Puyallup River, dredging/construction of waterways for the purposes of navigation and commerce, steepening and hardening formerly sloping and/or soft shorelines with a variety of material, and the ongoing development of the Port of Tacoma and other entities has resulted in substantial habitat loss. Marsh areas have been filled for commercial uses, residences, barns, roads, and domestic garbage disposal. Other habitat losses are the result of contaminated water and sediment from industrial and domestic discharges. Dredging and diking, and channeling the Puyallup River over the past century altered the suitability of habitat to wetland and aquatic plants, benthic invertebrates and to listed salmonids (USFWS and NOAA, 1996). In addition, the current distribution of salmonids in the Puyallup basin is affected by dams, weirs, culverts, screens, falls, and other artificial or natural features which may hinder or obstruct their passage, as well as by changes to the hydraulic regime and other habitat modifications.

Land-use in the Puyallup River watershed cumulatively contributes to degradation of water quality in the river that is carried to its mouth and into Commencement Bay. For example, recent monitoring studies by the U.S. Geological Survey in 23 urban streams in the Puget Sound basin routinely found a diverse mixture of insecticides, herbicides, and other biocidal compounds (Scholz *et al.* 2000; U.S. Geological Survey 1999). In concentrations typically found in the environment, the commonly used

organophosphate, diazinon, has been shown to disrupt antipredator and homing behaviors in chinook salmon (Scholz *et al.* 2000).

The clean up of contaminants has been a high priority in Commencement Bay. As a result of ongoing negotiations between state, federal and Tribal agencies, and the Port of Tacoma and other responsible parties, the inner bay's sediment quality has improved. The Sitcum Waterway Remediation is one result of the clean-up effort. The Port of Tacoma dredged the Sitcum navigation area between 1993 and 1995. Based on this and other remediation actions, the U.S. Environmental Protection Agency removed both the Sitcum and the Blair Waterways from the National Priorities List in 1996. As negotiated settlements these remediation actions are typically coordinated with major Port improvements. For example, about 24 acres of upland was created for Sealand storage and operational improvements with the disposal of contaminated Sitcum and Blair sediments. This action also deepened the Blair Waterway's navigation channel and berth areas to -48 feet MLLW. As mitigation for lost habitat afforded by the Milwaukee Waterway, shallow water habitat was created at the remaining portion of the Milwaukee.

As summarized by Simenstad *et al.* (1993), investigations of epibenthic invertebrate communities in Commencement Bay have been limited. Collections have been rarely comparable. No single investigation described epibenthic communities in all the water bodies at one given time. The majority of the studies focused on evaluating an area as juvenile salmonid prey habitat with little consideration given to the effects of contamination on the whole epibenthic community. Therefore, information regarding impact of contaminants and shoreline modifications to epibenthic communities is generally sparse. Epibenthic taxa considered reliable indicators of natural assemblages, and vulnerable to persistent habitat alterations or pollutant effects (e.g., harpacticoid copepods such as *Harpacticus* spp., *Tisbe* sp., and *Zaus*, and gammarid amphipods such as *Corophium* sp. and *Eogammarus confervicolus* that are prey of juvenile salmon), do not show any consistent time-series trend in their occurrence in the Waterways. In their review of past, albeit sparse, data-sets on epibenthic sampling in Commencement Bay, Cordell and Simenstad (1988) identified several trends that enabled them to speculate on historical changes:

1. The data consistently show a trend toward higher taxa richness and species diversity at lower intertidal and shallow subtidal, as opposed to higher intertidal habitats. This may be due not only to the greater exposure time of the higher habitats, but to the beach substrate and slope (very much related). Lower gradient portions of the beach are more conducive to epibenthic production than are high gradient sections because the lower the slope, the higher the retention of water and organic matter (detritus) which supports small epifauna. Therefore, loss of low gradient shoreline and replacement with high gradient structure (riprap, pier aprons, slip margins) probably represents a loss of epibenthic production.
2. In two studies reviewed by Cordell and Simenstad (1988), where comparisons were made between a uniform hard substrate (pier aprons, boat ramp) and adjacent "natural" substrates, taxa richness and density were lower on the hard substrate. Cordell and

Simenstad (1988) infer that replacement of soft or unconsolidated sediment with rock or concrete probably results in decreased epibenthic production.

3. Stressed epibenthos communities existed, or still persist, in certain waterways which have been both acutely and chronically contaminated and do not have a regular rate of sediment accretion, due to their removal from the suspended sediment-laden Puyallup river plume, e.g., Hylebos, Sitcum and City Waterways.
4. Compared to the historic habitat structure of the Puyallup River and Commencement Bay estuary, which was composed almost exclusively of low-gradient, fine unconsolidated sediment mudflats and salt marshes, the high-gradient, coarse sediment and vertical hard-substrate habitats that now prevail do not support the historic complexity and production of epibenthic crustaceans.

It has been well documented that the nearshore habitats in Commencement Bay have been severely altered by urbanization, Port and industrial development. The Commencement Bay cumulative impact study (U.S. ACOE *et al.*, 1993) describes impacts that have historically occurred to aquatic resources in the bay. This effort documents substantial alterations to the historic shoreline and the Puyallup River delta. For example, the Puyallup River delta aquatic habitats have been reduced to approximately half the area with less than 10% of the former intertidal mudflats. In Commencement Bay, of an estimated 2,085 acres of intertidal mudflats presumed present in 1877, about 187 acres remain, a loss of 91%. Also, an estimated 3,894 acres of emergent marsh habitat once occurred in an extensive band between MHHW and the present location of the Interstate 5 freeway. Of this habitat, an estimated 57 acres, or 1% remain. Most of this habitat loss was a direct result of Port and industrial development, flood control, and agricultural use. Beginning in the 1870s industrial and port development caused tidal areas to be covered, the meandering Puyallup River straightened and diked, and industrial and port operations were built on filled areas of the delta. Extensive subtidal waterways have been dredged into the former intertidal mudflat.

There are 27.9 miles of shoreline from the southern end of Ruston Way to the northern end of Brown's Point, and 532.2 acres of intertidal and shallow subtidal habitat (PIE 2000), not including the lower Puyallup River. The survey conducted by PIE (2000) found there are about 5 miles of the shoreline covered with over-water structures (30 acres) and 1.8 miles were obstructed with bulkheads. The substrate composition of the intertidal and shallow subtidal habitat was predominantly fine grain material but also included a significant amount of shoreline armoring, such as riprap (17 percent).

A large portion of this habitat historically had slopes typical of estuarine mudflats. The shoreline modifications in the waterways have also impacted the distribution of subtidal habitat, causing a significant change in the depth distributions in the waterways. The trend has been toward a wider and deeper waterway with engineered side slopes. The result is waterways with a greater proportion of deeper water than shallow water and reduced intermediate depths typical of a natural slope. This change has resulted in both significant physical and ecological functional losses of fish habitat and productivity.

B. Status of the Species within the Action Area

Artificial propagation programs provide the majority salmonid population in the Puyallup River. The White River spring chinook population, which is listed as critical by state and tribal fisheries managers, now depends largely on artificial production, such as the Muckleshoot White River Hatchery (SASSI, 1992). The White River spring chinook stocks have lately experienced a tenuous rebound as escapement has steadily increased from the historic lows of the 1980s. Non-tagged returns of White River spring chinook adults in 2000 was 1,732 individuals. This was the largest documented return in over 30 years. This increase is consistent with larger numbers of chinook in the Columbia River during 2000, indicating good ocean survival (Tim Tynan, NMFS, pers. comm., 2000).

The above discussion notwithstanding, the paucity of data makes it difficult to determine the status of Puget Sound chinook within the action area. Overall abundance of chinook salmon in this ESU has declined substantially from historical levels, and many populations are small enough that genetic and demographic risks are likely to be relatively high (63 Fed. Reg. 11494; March 9 1998). Escapement of Puyallup River/White River chinook are moderate in comparison to escapement data from other runs within the Puget Sound ESU. Recent 5-year geometric mean spawning escapement for the Puyallup River/White River average around 1000-10,000 fish. Both long- and short-term trends in abundance are predominantly downward, and several populations within this ESU are exhibiting severe short-term declines (63 Fed. Reg. 11494; March 9 1998). Trends in estimated abundance of the Puyallup River/White River chinook appear to be increasing from 1-5%. However, according to Nehlsen *et al.* (1991), and Myers *et al.* (1998), these stocks pose special concern and moderate extinction risk, respectively.

Chinook salmon of the Puyallup River basin primarily exhibit ocean-type life history strategies, with smolts migrating to the ocean during their first year, maturing at ages 3 and 4, and have coastal-oriented ocean migration patterns (Myers *et al.*, 1998). As previously stated, three runs of chinook salmon inhabit the Puyallup River basin including a spring run in the White River, a summer/fall run in the White River, and a fall run in the Puyallup River (SASSI, 1992). Puyallup River fall run chinook salmon were listed by state and tribal fisheries managers as a stock of special concern and spring chinook are considered to be nearing extinction (Salo and Jagielo, 1983, *in* Parametrix, 2000). The Washington Department of Fish and Wildlife recently listed the status of the White River summer/fall run chinook salmon as unknown due to inconsistent spawner survey data (SASSI, 1992). The glacial melt waters typical of the Puyallup River make it impossible to conduct spawner surveys there. Resource managers have had to rely on returns to an index area on South Prairie Creek, tributary to the Carbon River, to model chinook spawners in the Puyallup.

The summer/fall run of chinook salmon in the White River is distinct from the spring run based upon run timing, and distinct from the fall run based on geographic distribution of spawners. Spawning occurs from late-September through October, peaking in late August and early-September (Salo and Jagielo, 1983 *in* Parametrix, 2000). Spawning occurs from late-September through October in the lower

White River, lower Clearwater River, and lower Greenwater River (SASSI, 1992). The summer/fall chinook stock is considered wild (SASSI, 1992).

Puyallup River fall chinook salmon are distinct from other chinook runs based on their run timing and spawning distribution, which occurs in the Puyallup River upstream of Sumner, and in tributaries including the Carbon River, South Prairie Creek, Wilkeson Creek, Voight Creek, and Clarks Creek (SASSI, 1992). Fall chinook primarily spawn from September through October, with most natural production occurring in South Prairie Creek. Non-native hatchery chinook releases into the Puyallup River have been made since the 1960s primarily with Green River stock. Status of the fall run chinook in the Puyallup River is not known due to inconsistent spawner survey data (SASSI, 1992).

C. Factors Affecting the Species in the Action Area

The biological requirements of the listed species currently are not being met under the environmental baseline over the ESU. Declines in relative abundance for Puget Sound chinook may be attributable to extensive agricultural, port (including industrial and commercial), and residential development, as well as flood control over the past 150 years. To improve the status of the chinook, significant improvements in the environmental conditions of the critical habitat are needed.

To evaluate the factors affecting the species covered in this biological opinion, NMFS uses the Matrix of Pathways and Indicators (MPI) approach. A general MPI for marine environments has not yet been fully developed. For this analysis, NMFS adapted the MPI originally developed for similar assessments in the forested environment. The MPI describes pathways which are major environmental factors affecting salmon in the natural environment. Pathways in the original MPI include water quality, physical habitat, and habitat access. The MPI also describes “indicators” which are elements of pathways. For example, indicators for water quality include temperature, sediment, and chemical contamination. The pathways that are implicated for analysis under the proposed action include water quality, physical habitat, and biological habitat. These pathways are suggested for analysis because of the potential that the activities underlying this proposed action are likely to affect them. The MPI approach provides the assessment tool to evaluate the current environmental baseline condition.

In the action area, specific factors that may affect the quantity and quality of habitat for chinook include: modified shoreline substrate composition and slope, habitat access, water and sediment quality, shade and light effects, and preferred prey abundance and accessibility. For example, an indicator for habitat quality in the brackish oligohaline portion of the lower Puyallup River, would be the lack of habitat remaining for chinook to reside and transition from fresh to saltwater.

Substrate composition along the shoreline in the vicinity of the project site varies from mudflat (near the mouth of the Puyallup River, near the Milwaukee Waterway, and again in the Hylebos adjacent one of the mitigation sites) to steeply sloped armored faces made of large cobbles and boulders. Very little aquatic vegetation is present near the proposed pier apron. Attached algae, such as rock weed (*Fucus sp.*) and *Ulva*, is visible at lower spring and summer tides. In addition, at the project site, some upland vegetation is beginning to establish on top of the riprap face, above ordinary high water.

The shoreline substrate along the north shore of the action area out to Browns Point and the south shore to Point Defiance is comprised of a mix of materials. Natural conditions can be described as shallow gradient beaches with sand substrate and some eelgrass at low-tide elevation and typically larger-sized material (*i.e.*, rock riprap) at high tide levels (Duker *et al.*, 1989).

The typically productive biological and ecological attributes of an intertidal beach have been significantly diminished at the construction site, and throughout most of the Action Area. While the studies' robustness is limited by small sample sizes, the results of a 1991 investigation by Parametrix showed that non-pier apron stations had significantly higher total epibenthos and prey epibenthos than their paired apron stations. In the Sitcum Waterway where substrates and slopes were somewhat similar at the paired stations, the average abundance ratios of apron to non-apron stations (shaded vs. unshaded) were about 0.86:1 for total epibenthos and about 0.84:1 for epibenthic prey (Parametrix, 1991). The Washington Department of Fish and Wildlife analyzed this same data set and found errors in the earlier interpretations of the data and calculated ratios on the order of 0.5:1 (Randy Carman, 2000, pers. comm.).

Effects of over-water structures on the utility of the habitat to fishes are not unique to salmonids. For example, cage studies on the Hudson River estuary showed that juvenile fish had negative growth under large municipal piers (Duffy-Anderson and Able, 1999) during a time where fish had positive growth in open areas. This negative growth occurred despite the apparent availability of appropriate prey, indicating it was too dark under the piers to successfully forage. Inadequate growth rates can lead to higher rates of mortality, and based on these, and other earlier experiments, under-pier environments are poor-quality habitats for some species of juvenile fish. Much of the shoreline within all of the Waterways in Commencement Bay has been shaded by pier aprons. Studies of the under-pier ecology of juvenile pacific salmon in Commencement Bay by Ratte and Salo (1985), showed that chinook preferred not to go into the dark zone under piers to use the shallow riprap areas there. Most of the juveniles instead preferred to use the edge of the pier. Juvenile chinook are visual feeders. While some epibenthic prey exist under the piers in the nearshore shallows, the darkness creates very poor feeding conditions, similar to that found in the Hudson River studies. Juveniles found in the Sitcum Waterway are more likely to have fed on a planktonic diet (Simenstad *et al.* 1985; Simenstad *et al.* 1999, Simenstad 2000), another indication that while some epibenthic prey is available in the nearshore zone under the piers, it is not utilized by the chinook there. Indeed, fish abundance and species richness are typically low under piers (Parametrix, 1992; Able, Manderson, and Studhome 1998).

Light measurements taken by Ratte and Salo (1985) under the Terminal 4 pier in Commencement Bay suggest that the ambient light conditions at a 3-foot depth are adequate for active salmonid schooling and feeding. However, exploring the limits of the equipment used, NMFS and USFWS found that the analog meter used with the sensor has a resolution (error reading) of +/- .05 foot candles. The lower light levels reported by Ratte are lower than the "noise" that can be resolved by the instrument (Steve Karmazin, 2001, pers. comm. with USFWS). Moreover, the product literature from the manufacturer (LI-COR) indicates that the stability of the sensor decays at a rate of +/- 2% over a one year period. The age of the sensor used by Ratte is not indicated, but during a conversation with Mr. Fisher (Ratte), he indicated that he thought it was a couple of years old. The accuracy of the sensor therefore, was

likely lower than expected. This intimates that the light measurements taken by Ratte under the Terminal 4 pier could, in fact, have been zero. Therefore, it is NMFS opinion that light levels under such piers are low enough to preclude feeding and migration of juvenile chinook. In arriving at this opinion, NMFS relied in part on the work of Simenstad *et al.* (1999) which is a synthesis of the state of knowledge in relation to impacts of over-water structures on migrating juvenile salmon along Puget Sound shorelines.

Concentrations of metals in the water column along the shoreline at times exceed the Washington State ambient water quality criteria (Washington Department of Ecology 1995). These concentrations appear to be due to both ground water passing through contaminated upland soils in the action area, as well as (potentially) surface water loads originating from the site, and elsewhere in the action area. Outer Commencement Bay, in the vicinity of the action area, currently has the water quality classification of Class A. The bay has been listed on the 303(d) list of impaired waterbodies for not meeting its applicable water quality standards. The Department of Ecology (1995, in USFWS and NOAA, 1996) summarized high priority issues of concern in the Puyallup River/White River basin, including arsenic, lead, mercury and zinc in outer Commencement Bay.

Ship arrivals, berthing and departures may also affect the physical habitat and rearing conditions of juvenile chinook and other salmonids. Associated with the arrival and berthing activities of large ships is the generation of abrupt current action. Ship propellers generate approximately 244,000 cubic feet per minute currents and bow thrusters on the modern larger class vessels generate roughly 114,000 cubic feet per minute currents (Mark Mulligan, 2000, pers. comm. with USFWS). In addition, 90 percent of the ships that call have hulls painted with the anti-fouling agent tributyltin (TBT). About 70 percent of the ships calling to the Port of Tacoma are foreign flagged vessels from about 30 different countries. Seven of these countries have some regulations regarding TBT but they are generally the same or less restrictive than the U.S. The U.S. regulations include prohibitions of TBT-based paints on vessels less than 25 meters in length and a maximum leaching rate of 4 g/cm²/day for vessels greater than 25 meters. These restrictions do not apply to foreign flagged ships calling on U.S. ports. About 60 percent of the ships arriving at the Port of Tacoma are from countries that have no regulations on the use of TBT. It is estimated that two larger ships could release up to 1.14 kilograms a day based on the maximum leach rate. Concentrations at this leach rate could be between .4 and .5 parts per billion for a volume of water similar to the Sitcum Waterway. However, high levels may not be biologically available because of the potentially high rate of adsorption onto organic particles and into the sediments. TBT is very toxic to marine organisms. Effects include: acute morbidity at 0.96 to 31 ppb in fish, from 0.33 to 1.03 ppb in some algae, and from 0.1 to 2.1 ppb in invertebrates. TBT can cause growth effects, or anatomical deformities at concentrations as low as 0.02 ppb in invertebrates (EPA 1997).

IV. EFFECTS OF THE PROPOSED ACTION

NMFS' ESA implementing regulations define "effects of the action" as "the direct and indirect effects of an action on the species or critical habitat together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline." "Indirect effects"

are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 C.F.R. § 402.02).

Multiple stress factors will have incremental effects on the species, adding to the overall stress encountered throughout their life history. The effects of any one factor for decline can be complicated by the influence of others. The recent development history of a population can influence its response to any one factor for decline. For example, if a population was exposed to a prolonged series of high temperatures, lowered dissolved oxygen (DO), and/or water borne contaminants, it may be more readily infected with disease organisms that further weakens its resistance to new temperature, DO, and/or contaminant exposures, or other physical or biological factors. This initial exposure can leave the population weakened from energy depletion through inadequate food intake, high metabolic costs, and negative growth. The probability of increased mortality from predation, disease and competition in these cases is greater than when a population is confronted with only one factor for decline. Commencement Bay and the Puyallup River and Delta have undergone extensive physical changes that cumulatively adversely affect the ecological functions to which juvenile salmonids have evolved (Simenstad 2000). Therefore, the overlay of numerous factors for decline was considered for this project.

To evaluate direct and indirect effects associated with the proposed project, it is critical to address elements of the life history of Puget Sound chinook. The use of Commencement Bay as a rearing and migration corridor, and natural spawning in the Puyallup River has been documented (PIE 1999; SASSI, 1992; Duker *et al*, 1989; Simenstad *et al*, 1982; Simenstad, 1999). The limited shallow water habitat in the vicinity of the project site raises questions about the present day use of the area for rearing (Simenstad *et al*. 1993, Simenstad 2000). However, some shallow habitats/beaches to the south (near the mouth of the Puyallup River westerly to Point Defiance) and north (mouth of the Hylebos out to Browns Point) of the project site, and the existing exposed riprap banks, appear to contribute various ecological functions for rearing habitat. The Puyallup River plume also contributes to the amount of available rearing habitat. In large part the plume helps salmonids make the osmoregulatory transition from a fresh to marine environment. In addition, the Puyallup River plume functions as a delivery system for neustonic prey (Simenstad, 2000, pers. comm.).

The proposed action, pier extension and habitat enhancements, is likely to adversely affect Puget Sound chinook. NMFS considers the project to produce short-term effects such as movement of early juveniles offshore away from their preferred habitat during pile driving activities, and short-term water quality exceedances through turbidity and potentially through exceedances of water column metals concentrations. In addition, the project will produce long-term effects such as the loss of productivity of epibenthic invertebrates, and the loss of this functional habitat to chinook salmon. The proposed project will also provide some beneficial effects resulting from the habitat enhancements.

A. Direct Effects

Direct effects are the immediate effects of the project on the species or its habitats. Direct effects result from the agency action and may include the effects of interrelated and interdependent actions. Future

Federal actions that are not a direct effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not evaluated.

The direct effects of the project are related to the extent and duration of the construction activities in the water and whether the fish are migrating and rearing at that time. Direct effects of the project are also related to immediate habitat modifications resulting from the project. In the proposed project, short-term negative effects may occur during various construction activities. These activities include: pile driving and removal, demolition at the north and south edge of the existing pier, pile cap concrete pours, augmentation of shoreline substrate along the outer 100 feet (western end) of the pier extension/truck access, the construction of the intertidal beach in the Hylebos Waterway, and the construction of the high marsh wetland in the Gog-Le-Hi-Te wetland.

1. Pile Driving and Removal

The response of salmonids to sounds in their environment is varied and not yet fully understood. The classic fright response of salmonids to sound is the “startle” or “start” behavior (Moore and Newman 1956; Burner and Moore 1962; VanDerwalker 1967). Such behaviors involve sudden bursts of swimming that are short in duration and distance traveled, usually less than 60 cm (Feist 1991). Experiments that have used pulsed, rather than continuous, sound stimuli on juvenile fish demonstrated more pronounced responses, such as “startle” or general avoidance (McKinley and Patrick 1986). Pile driving most closely resembles pulsed sound stimuli. Based on the known range of salmonid hearing, pile driving noise would be expected to be heard by salmonids within a radius of at least 600 meters from the noise source (Feist 1991; Feist *et al.* 1992), although, salmon at this range may not exhibit any visible response. Throughout the study of pile driving effects on juvenile salmonids, Feist (1991) found pile-driving operations affected the distribution and behavior of fish schools around the site. For example, the abundance of fish during non-pile driving days was two fold greater than on days when pile driving occurred. Impact pile driving can generate sound pressure levels (SPL) in excess of 192 dB (re: 1 Pa) (Carlson 1997), which is above the 180 dB shown to damage the hair cells of the inner ear of *Astronotus ocellatus* (Hastings *et al.* 1996). Long-term exposure to these sounds (4 hr) was required to induce the observed damage, whereas the sounds produced by impact pile driving are of short duration. While the minimum SPL required to inflict damage on the hair cells of fishes by such sounds have not been determined, Feist *et al.* (1992) theorize it is conceivable that salmonids in close proximity (less than 10 meters) to pile driving may experience temporary or permanent hearing loss.

Pile driving sounds might mask other auditory cues important to juvenile salmonids (Feist *et al.* 1992); such as the sounds of approaching predators. During their study of potential impacts of pile driving on juvenile salmon at the Navy Homeport development in Everett, Washington, Feist *et al.* (1992) found a very close correlation between the peak of the out-migrant run of juvenile pink and chum salmon with peak abundance of piscivorous birds (western grebes) near pile driving activities. Many birds were observed feeding on juvenile fish. The precise correlation of the grebes with the peak of the outmigration suggests that these diving birds were feeding on the young salmon. Predator-avoidance flight behaviors may have been modified, as the juvenile salmon were less responsive to the movements of observers during pile driving activities.

Depending on the timing of the pile driving, juvenile chinook salmon may or may not experience adverse effects. To minimize potential adverse effects on migrating chinook salmon juveniles, the Port of Tacoma proposes work to be done when fewer chinook are expected to be in the area. The Port suggests no in-water work between March 15 and June 30, to protect the bulk of the chinook out-migration. However, NMFS must consider effects on early and late arrivals of juvenile chinook to the Commencement Bay estuary, the significance of these fish for recovery, and the amount of take that may occur if pile driving and other in-water work is allowed when these early and late arrivals are in the vicinity. Historically, under their authority from RCW 75.20.100 and WAC 220-110, the Washington Department of Fish and Wildlife (WDFW) issued timing restrictions on their Hydraulic Project Approvals (HPA's) for in-water work (Appendix Two). No in-water work has been allowed between March 15 to June 15 of any year. This restriction was to protect "most of the annual nearshore migration of juvenile salmonids." However, after analysis of the Puyallup Tribe of Indians beach seine data, the WDFW issued the Port of Tacoma an HPA for this pier extension (December 19, 2000) with a provision that allowed in-water work only between August 16 and February 14 of any year. Based on NMFS' analysis of the Puyallup Tribe of Indians data, this timing would clearly protect all segments of the three Puyallup River chinook runs. The proposed in-water work schedule of the Port's likely would not. The WDFW analysis was conducted for all species of salmon, and the timing restriction imposed on the Port through the HPA is for the protection of all salmonids (Molenaar, 2000, pers. comm.), while NMFS Biological Opinion only considers the effects to ESA listed Puget Sound chinook salmon.

The early juvenile chinook salmon out-migrants are very small, both in numbers and in size, relative to the mid- to late spring arrivals. In addition, the later arrival of hatchery fish masks the continuing presence of smaller juveniles later into the summer. The point at which the smaller ocean-type chinook are no longer in the action area is not fully documented. Most of the chinook caught during the Puyallup Tribe beach seine activities did not have length measurements taken. These fish are the most dependent on the nearshore for refugia and feeding (Miyamoto *et al.* 1980, Simenstad 2000). In addition, these early arrivals may be but a remnant of former numbers and temporal uses of the historic habitat conditions of the Puyallup River delta, and Commencement Bay estuary described in Part II above. Pile driving elicits a flight response. The smaller salmonids still in transition to euryhaline conditions must disperse horizontally to stay in the less brackish or "fresher water" lens of their nearshore aquatic habitat. In the altered habitat state of the Sitcum Waterway, the chinook's flight response would take them into deeper water, away from preferred prey, and away from the protection from larger predatory fish offered by the shallow nearshore. Their flight response, especially if repeated several times, also burns calories which may affect their growth. It has been well documented that once salmon enter the estuary, rapid growth is essential to enhancing survival rates (e.g., Hoar 1976, Healey 1980, 1982 and 1991; Kjelson *et al.* 1982; Macdonald *et al.* 1987 and 1988; Miller 1993; Simenstad *et al.* 1982). Finally, the flight response separates individuals from the safety of the school. This again may affect survival rates as lone individuals are likely to be more prone to predation than those in schools.

It is not known to what extent pile driving may affect returning adults staging to enter the Puyallup River. However, NMFS does not expect, given the location of the sport fishery activities, that the adults returning to the Puyallup River will be adversely affected.

2. Shoreline Shading

Long term direct effects will result from increased intertidal and nearshore shading. The new pier will shade more than 700 feet of intertidal beach. This area is composed mostly of riprap, and is steeply sloped (2:1) from above the mean higher high water (MHHW) mark of +11.8 feet down to well below the photic zone. The pier extension over this area will affect remaining ecological functions supporting juvenile chinook by blocking sun and extending a dark shadow over the nearshore migratory zone. Piers present sharp underwater light contrasts by casting shade under ambient daylight conditions, and they can also present sharp underwater light contrasts by casting artificial light under ambient nighttime conditions. Studies summarized by Simenstad *et al.* (1999), repeatedly verify that changes in the underwater light environment affect juvenile salmonid physiology and behavior. The direct effect of this shading on chinook salmon will be the loss of this shallow water habitat for normal migration, feeding and refuge from predators. While prey organisms will still be produced by the habitat below, it will be produced at a significantly lower rate (Carman 2000, pers. comm.) and to the extent these organisms are still present, their availability to, and utilization by, chinook will be significantly reduced (Simenstad *et al.* 1985, Simenstad 2000, Simenstad, pers. comm., 2001). Most of the chinook will respond to the completed pier extension and truck routes by avoiding the area below. In addition, the pier extension and truck route addition will extend to the end of the waterway at its mouth where chinook are more abundant. Studies have shown that the mouths of each of the waterways are more heavily used by chinook juveniles than inside the waterways (Duker *et al.* 1989). NMFS' analysis of the Puyallup Tribe of Indians beach seine data (Table 1), shows that substantially more chinook will be affected by the pier extension than will benefit from the habitat enhancements proposed in the Hylebos Waterway as part of this same action. The pier will effectively move most of the juvenile chinook out away from shore into deeper water where they will be forced to feed on pelagic prey and where they may be vulnerable to predation (Ratte and Salo 1985; Simenstad *et al.* 1999). Some of these chinook will have already made the transition from nearshore benthic to pelagic feeder and therefore some component of the annual run may be less severely affected (Duker *et al.* 1989).

In their summary of effects of over-water structures on salmonids, Simenstad *et al.* (1999), found that the responses of juvenile salmon were extremely size-dependent. The smaller the fish, the more their migration appeared behaviorally constrained to the shallow water habitats, and the more likely they were to avoid entering shaded habitats. Furthermore, salmon fry tend to use both natural refuge (e.g., vegetation such as eelgrass) and darkness (e.g., shading from docks and floats and turbidity) as refuge but migrate along these edges rather than penetrate them.

Simenstad *et al.* (1999) found that the scale of shading is also a factor. The physical design can influence whether the shadow cast on the nearshore covers sufficient area and scope of darkness to constitute a barrier. NMFS believes that the Port of Tacoma pier extension will be of sufficient size and scope to cause a barrier to migration, even when ships are not at berth. When migratory pathways are

blocked by shading or other less preferred habitat, competing behavioral responses appear to result in fish confusion and often in delay of active migration (Simenstad *et al.* 1999).

Shading also affects primary production, which in turn, affects secondary production. The extension of the pier apron over this area will eliminate the small amount of algae and foreclose any future potential for upland vegetation to continue to establish. The loss of algae and ability for upland vegetation to establish reduces a component of the existing ecological functions and future ecological potential of the site. Decreases in light energy limits photosynthesis of diatoms, benthic algae and associated epiphytes and other autotrophs (Simenstad 1997; Simenstad *et al.* 1999). These contribute to habitat structure and food webs important to juvenile ocean-type salmon in estuarine and nearshore marine environments. With photosynthesis eliminated, much of the base of the food web is also eliminated. Organic litter, or detritus, forms the base of food webs in Puget Sound. The composition of organic matter contributing to the estuarine detritus pool varies significantly depending on location, extent and type of watershed and estuary. Loss of virtually all photosynthetic potential in the Sitcum Waterway will mean all organic debris must be imported by wind and currents to support a detrital-based food web there.

Artificial light cast from the new pier is expected to be no more than 66 lux (PIE 2000). It is not known how this light cast on the water at night will affect juvenile chinook. However, several studies have shown that the effect is dependant upon several factors. Prinslow *et al.* (1980) found that light levels as low as 2-13 lux caused juvenile chum salmon to congregate. Wickham (1973) and Puckett and Anderson (1987) found fish to be attracted to mercury lights under certain conditions. Nemeth (1989) found increased coho and chinook activity with mercury light and less avoidance in comparison to strobe light conditions. During night tests, Puckett and Anderson (1987) found that steelhead initially avoided mercury light, then swam toward it. The strength of the attraction to a solid, non-flashing light is dependent upon the intensity of the light and the level of light to which the salmonids have previously acclimated (Puckett and Anderson 1987). Both the daytime shadow and the nighttime artificial lights change the underwater light environment, altering juvenile salmonid physiology and behavior. These changes pose a risk of affecting fish migration behavior and placing them at increased mortality risk.

The increased risk posed by light changes could result from the following (Simenstad et al 1999):

- delays in migration caused by disorientation;
- loss of schooling in refugia because of fish school dispersal under light limitations;
- a change of migratory route into deeper waters, without refugia, to avoid light change.

3. Shoreline Remediation

a. Enhanced Substrate Under the Pier

The Port has included in the proposed action, construction activities that will improve some ecological functions for juvenile salmonids, including chinook, and thereby minimize some effects of the proposed pier and truck access ways.

The Port will place a minimum of 80 cubic yards of two and one-half inch minus angular rock (2 ½" minus) on a portion of the riprap slope that is to be covered by the proposed pier extension and bayward truck access way. The purpose for this select material is to improve the characteristics of the substrate for production of epibenthic prey for juvenile chinook. The material will be placed between MHHW (elevation +11.8 feet, MLLW) and -10 feet MLLW for a distance of approximately 100 linear feet of the shoreline. While it is not expected that the material will form a continuous layer over the existing riprap, it will fill the interstitial spaces between the riprap producing a mosaic of habitat that varies from gravel to riprap. Because of the orientation of the waterway, NMFS believes that this material will produce some beneficial affect on chinook prey-base production and that because some diffuse sunlight will still penetrate through the water column and onto the intertidal beneath the bayward end of the pier and truck access way chinook will feed there (Simenstad 2000). This added component of the proposed action was essential in minimizing some project effects. However, NMFS' review of best available science (described above), leads NMFS to the finding that enhancement of feeding opportunity provided by increased prey production will not be available to juvenile chinook with the overhanging pier and truck route. NMFS believes the material might be sifted significantly as a result of the pile driving and that a second application will be required.

b. Upland Conversion to Intertidal Beach - Hylebos Waterway

The Port proposes to construct an intertidal beach at a small peninsula located on the eastern side of the Hylebos Waterway immediately bayward of East 11th Street. The site is owned by the Puyallup Tribe of Indians and is adjacent to Tribal land that has been designated for habitat conservancy and restoration. The peninsula separates a quiescent mudflat from the Hylebos Waterway. The upland's current elevations are from +11.8 feet to +18 feet MLLW. The Port's proposed habitat enhancement is to excavate and grade a portion of the peninsula and create a gently sloping upper intertidal profile. The site would be graded to connect with the existing intertidal habitat. The newly constructed intertidal profile would primarily extend from approximately elevation +11.8 feet to +8.0 feet MLLW, and, in some cases, may go as low as +6.0 feet MLLW to allow blending of contours with existing conditions. This action by the Port will improve nearshore upland and aquatic ecological functions, and also increase capacity for juvenile salmon. However, NMFS does not believe chinook salmon will benefit to the extent they will be impacted by the pier extension, even with the placement of the 2 ½ inch minus material beneath the bayward end of this new pier.

c. Upland Conversion to Connected High Marsh Wetland - Lower Puyallup River

The Port also proposes to create additional aquatic habitat by expanding on an existing wetland habitat created in the lower Puyallup River. The existing site is known as the Gog-Le-Hi-Te wetland mitigation site. This 9.6 acre site was created in between July 1985 - July 1986 as mitigation for a wetland filled upriver by the Port of Tacoma. Approximately 5.4 acres of the site is wetland and 4.2 acres are upland (Thom *et al.* 1987). Originally, this entire area was a connected marshland adjacent to the Puyallup River. During the 1940s, a levee was constructed by the U.S. Army Corps of Engineers which separated the wetland from the river. Subsequently, the area, including this location, was used for a municipal refuse disposal site serving the city of Tacoma. Over the years the created wetland site has been extensively monitored (e.g., Thom *et al.* 1987, 1988, 1990, 1991; Shreffler *et al.* 1990; Parametrix 1994; Watershed Dynamics 1995), and has been shown to continue to serve target resources for which it was designed and is ecologically dynamic.

The Port's proposed action, at the northern portion of the eastside of the Gog-Le-Hi-Te site, would convert upland grassy habitat into high marsh habitat. Incorporated into the design criteria would be the goal to increase chinook residence time in the overall wetland, including the area to be constructed. Elevations would support high elevation marsh, roughly +12 feet MLLW. As a part of this action, the Port will remove portions of an approximate 4 foot deep garbage layer that blankets the entire site. Due to the high elevation of the constructed marsh, direct use by chinook salmon will be limited to water events where river flows and tides are both high.

4. Take During Monitoring

Biological monitoring conducted at the Hylebos site will cause direct take of chinook salmon individuals. Beach seine sampling could injure or kill chinook juveniles outright. The sampling effects could be reduced by minimizing handling of the fish, and keeping fish immersed in water during processing.

5. Stormwater Effects

Stormwater will run off of the new facility uncontrolled. The new pier will add approximately 54,000 square feet of impervious surface to the existing facility. The stormwater which flows off of the existing facility, along with that flowing off of the new facility will enter the Sitcum Waterway with no water quality controls incorporated into the Port's proposed action. Long term direct effects to chinook salmon are expected to occur. Oil and grease, generated from the continuous flow of trucks through the facility, will contribute PAH's to the water column. In addition, it is reasonable to expect zinc and copper from tire and brake wear to enter the water via stormwater runoff.

Water quality limitations have been identified as examples of potential causes of injury to listed fish in both final and draft regulations developed to implement the ESA (NMFS, 1998b; NMFS, 1998c). The definition of "Harm" includes discharging pollutants, such as oil, toxic chemicals, radioactivity, carcinogens, mutagens, teratogens, or organic nutrient-laden water including sewage water into a listed

species' habitat as possibly causing take. Water quality and quantity limitations are associated with triggering the onset of sublethal effects such as disease in previously infected salmonid populations. The onset of disease is thought to be exacerbated by the added stress of poor water quality and quantity conditions (NMFS, 1998c). In addition, factors associated with urbanization, including pollutants, have been implicated in 58% of the declines and 9% of the extinctions among 417 surveyed stocks (NMFS, 1998d).

B. Indirect Effects

Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur (50 C.F.R. § 402.02). Indirect effects may occur outside of the area directly affected by the action. Indirect effects may include other Federal actions that have not undergone section 7 consultation but will result from the action under consideration. These actions must be reasonably certain to occur, or they are a logical extension of the proposed action.

1. Altered Rearing Habitats

Availability of rearing habitat is important to outmigrating smolts. During their residence in the estuary, juvenile salmonids require refugia for resting, smoltification, and predator avoidance. Many factors affect the magnitude of predation mortality, including the characteristics of prey, characteristics of predators, and characteristics of the environment and critical habitat (e.g., habitat, and environmental stresses such as contaminant stress). Mortality during early marine life is often quite high with mortality rates up to 77% occurring during the first several days of life in saltwater (Salo *et al.* 1980). Despite considerable speculation about the effects of over-water structures increasing predation on juvenile salmon, evidence supporting this contention is scientifically uncertain at best (Simenstad *et al.* 1999). Quantitative assessment of predation around over-water structures is severely lacking. In their analysis of the literature, Simenstad *et al.* (1999) found that the significance of predation to a migrating population of juvenile chinook has never been assessed empirically. Ratte and Salo (1985) attempted to verify enhanced predation associated with over-water structures, and found that predation was shown to be relatively insignificant, and limited to one or two species of predators. Unfortunately, Ratte and Salo's results are based on very low numbers of fishes caught, including predators, and the results are therefore inconclusive. An interesting finding in Ratte and Salo's predator study was that out of the 17 individual predators caught in the control sight (outside the influence of a pier shadow) 9 of these were salmonids. Out of the 19 individuals caught at the treatment site (under the pier), only two were salmonids (one adult cutthroat and one juvenile coho). Further they found that no studies have examined the mortality specifically due to predation, much less that attributable to predators specifically associated with over-water structures.

2. Increased Shipping Impacts

Indirect effects include effects associated with the berthing and departure of each Maersk/Sealand vessel. Vessels generate approximately 244,000 cubic feet per minute current and the bow thrusters on the larger vessels an additional 114,000 cubic feet per minute current. While the vessels berth, the

pilot must assist the tugs by using the bow thrusters and propeller. These current velocities can disturb sediments in water as deep as 30 - 40 feet (Ebbesmeyer 2000). Effects include: removal of fine sediments, dislodging and burying of benthos, scour, and turbidity. Ratte and Salo (1985) found juvenile chinook migrated along the pier face, rather than below the pier itself. Schools of juvenile chinook could be dispersed by these sudden torrents. NMFS has observed this effect on migrating salmonids along the nearshore at ferry terminals. Propwash, produced as the ferry is docking, creates waves which can disrupt schools of fish and wash them deep under the pier, where the waves then break against the riprap beach (Hooper, pers. obs., 1999). Turbulence studies at ferry terminals have also demonstrated the effects of propeller wash turbulence or current velocity on plants, substrate surfaces, and bathymetry (Thom *et al.* 1996, Thom and Shreffler 1996). Substrates can become scoured and rearranged, eliminating the establishment of detrital food webs that provide food for epibenthic prey of juvenile salmonids. Re-mixing of substrates can also be a supply of organic material that can contribute to food webs (Grette, pers. comm., 2001).

In addition to current disruptions, ships at dock run electric generators cooled by seawater. The returning water is 10 - 15 degrees warmer than ambient Sitcum Waterway water temperatures. The effects that this warmer water may have on chinook is unknown.

Fish might be effected by the painted hulls of ships. Ninety percent of ships that call on U.S. ports are treated with tributyltin (TBT) antifouling paint. While it is not known how many of the Maersk ship (if any) hulls are protected by TBT, NMFS must assume that some are. TBT is known to cause adverse effects in benthic species at very low concentrations. NMFS has some concern over the potential toxicity of TBT to marine invertebrates important to the diet of chinook salmon. Several studies demonstrate that TBT is very toxic to marine invertebrates (Maguire 1987, Cardwell and Meador 1989, Heard *et al.* 1989, Fent 1996, Rexrode and Spatz 1997). Based on the tissue residue approach described by Meador (2000), and the available data, protection against severe adverse sublethal effects for many, but not all salmonid prey species, should be achieved with a maximum TBT sediment concentration of 6,000 ng/g organic carbon. For example, in a sediment composition with 3 % total organic carbon, this would equal 180 ng/g dry weight. At this sediment concentration, no adverse effects on migrating salmon are expected. However, Meador (2000) cautions, that if substantial tissue residues are detected (e.g., greater than 500 ng/g dry weight) in juvenile salmon, the above recommendation should be reconsidered. The goal is to protect salmonid prey against severe effects; it should be stated that at this sediment concentration some sublethal effects on other benthic invertebrates, especially molluscs, are expected.

Combined with the above described effects associated with ship propeller's and bow thruster's, the potential long term effects on chinook salmon from TBT, and the remobilization of TBT with each ship's arrival and departure, could be substantial and should not be ignored.

Bunkering ships with fuel presents further risks to chinook, directly and indirectly. Bunker oil spills have occurred within Commencement Bay in the past, and may occur again. In the past 10 years at least three bunkering mishaps have been documented within the action area. In 1992 and in 1993 two spills events occurred in the Blair Waterway; the *Sun Rose* spill was 850 gallons, and the *Nosac Forest* spill

was approximately 7000 gallons. A third spill happened in 1998, when the Russian vessel the *Anadyr* spilled approximately 5000 gallons in the Sitcum Waterway. The worst of these was the *Nosac Forest* spill because of the timing. This accident took place during the juvenile chinook outmigration period and state biologists (Hooper 1993, pers. observ.) documented direct and indirect effects to White River spring chinook, which at that time was listed as a “critically depressed” stock (SASSI 1992). Increased shipping to the waterways means, in all likelihood, increased fuel oil bunkering. This obviously increases the risk of spills that could adversely affect chinook and chinook habitat.

C. Effects on Critical Habitat

The proposed action will affect essential features of the designated critical habitat of Puget Sound chinook. The mechanisms of these effects have been described above. NMFS designates critical habitat for listed species based on physical and biological features that are essential to each species. Essential features of critical habitat for chinook salmon include: adequate substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, and safe passage conditions. Of these essential features, NMFS determined that the construction activities associated with the pier extension project will influence shoreline use, prey production, refugia space and riparian vegetation. The construction activity may influence water quality in the form of turbidity, temperature, oil and grease, metals and potentially heightened TBT concentrations.

The minimization components of the project will enhance some important ecological functions for chinook. In the Hylebos, the upper intertidal habitat created will increase chinook rearing, refugia and migration capacity when the water line falls within these tidal elevations (approximately 40% of the time). The placement of 2 ½ inch minus material over the riprap along the outer 100-foot section to be covered by the new pier will likely create more preferred prey organisms for juvenile chinook; however, the availability of these prey from the outer edge may be limited to the point of adequate sunlight penetration.

The expansion of the Gog-Le-Hi-Te wetland will increase primary and secondary production; provide increased aquatic- and terrestrial-based prey organisms for juvenile chinook; may increase chinook residence time in the wetland, and may export more detritus and prey to the wetland/ Puyallup River and out to Commencement Bay. The expanded wetland will provide more, albeit limited, direct-use habitat for chinook during high tides and high river flows. The actual percentage increase of each of these benefits to chinook is impossible to determine. However, basic biological and ecological principles would support these assumptions. For example, Sommer *et al.* (2001), provide evidence the primary floodplain of the lower Sacramento River provides better rearing and migration habitat for juvenile chinook salmon than the river channel itself. This study showed chinook salmon increased in size substantially faster in the seasonally inundated agricultural floodplain than in the river. Improved growth rates were in part a result of significantly higher prey consumption on greater abundances of drift invertebrates. It has been speculated that expanding the Gog-Le-Hi-Te wetland will create its own channels which chinook will use, and the flow from these channels off the expanded wetland will deepen the channels of the existing wetland (C. Simenstad, R. Thom, and G. Grette, 2001, pers. comm.). Deepening the existing channels would increase the time that water stays in the channel and

thus increase the potential residence time of juvenile chinook. This action would result in a net benefit to critical chinook habitat, however it is not known to what extent contaminants from garbage left (remnants of an old land-use practice) in the soils at this site might cause adverse effects. Contaminants off the site, biologically available to juvenile chinook salmon and other aquatic and terrestrial species, could discount the full potential of any beneficial effects from this action.

V. CUMULATIVE EFFECTS

Cumulative effects are defined as “those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation” (50 CFR § 402.02). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Cumulative effects were discussed in the baseline analysis.

The volume of goods passing through Washington’s ports has grown dramatically in the past five decades, due largely to foreign trade. Statewide, total tonnage shipped has increased from a reported 29.7 million tons in 1953 to 52.3 million tons in 1999, about a 75 percent increase (WDNR 2000). The Seattle and Tacoma ports combined are second only to Los Angeles/Long Beach, California in container traffic for all U.S. ports. In 1963 one in nine jobs in the state was trade-dependent, today one in four jobs is tied to trade, and by 2005 the ratio is projected to be one in three jobs. Growth projections predict that Washington’s public ports will grow an average of 4 percent to 5 percent annually over the next 20 years. It is projected that shipping container traffic in Puget Sound alone will more than double by 2020 (WDNR 2000).

Significant improvements in the Puget Sound chinook rearing and migration in the lower Puyallup River delta and estuary and Commencement Bay are unlikely without changes in land and water-use practices, particularly stormwater management, source control and contaminated sediments cleanup, spill prevention and containment, port management practices, and shoreline development. Gradual improvements in habitat conditions for salmonids are expected and necessary in Commencement Bay as a result of a number of forthcoming activities. In the very near future, the EPA will oversee the cleanup of contaminated bottom sediments in the vicinity of the project site, as well as in many of the waterways at the head of the bay. While the Asarco sediment cleanup project is not being considered in this BO, it will have the beneficial effect on critical habitat by removing, through dredging or capping, a portion of the sediments contaminated with arsenic and copper. In addition, NMFS is aware that efforts, over the last seven years, have lead to the development of a Master Development Plan, which describes the framework for redevelopment within and near the action area. The framework includes elements for commercial and/or light industrial development, park and pedestrian access development, boat ramp renovation, as well as revegetation of steep slopes to the appearance of the forested hillsides similar to those to the north and south of the site.

One source of potential cumulative effects is from the use of pesticides used by the Metropolitan Park District of Tacoma on the park vegetation. Standard pesticide registration focuses on concentrations

that are lethal for fish when determining application rates. NMFS is concerned about sublethal effects such as neurological behavior effects stemming from standard rates of application of pesticides (Solomon and Giddings, 2000). Environmentally relevant concentrations of diazinon has been shown to disrupt homing and anti-predator behaviors in chinook salmon (Scholz *et al.* 2000). It is not known to what extent exposures to these chemicals can affect survival after transitioning to marine nearshore habitats. If there were to be an adverse reaction from sublethal doses, altered shoreline habitats typical of Commencement Bay may compound the effect.

Until improvements in non-Federal actions occur, NMFS assumes that future private and State actions will continue at similar intensities as in recent years. However, now that the Puget Sound chinook ESUs are listed under the ESA, and the 4(d) rule is in effect, NMFS assumes that private and State project proponents will take steps to curtail or avoid actions that would result in the take of chinook. Future Federal actions, including future cleanup actions and in-water and shoreline construction, will be reviewed through separate section 7 processes.

VI. CONCLUSION/OPINION

NMFS determines whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. NMFS' process for making jeopardy determinations for habitat-altering actions is explained in Appendix I. In making this determination, NMFS must consider the estimated level of injury or death attributable to: (1) collective effects of the proposed or continuing action, (2) the environmental baseline, and (3) any indirect or cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed species' life stages that NMFS also evaluates whether the action, directly or indirectly, is likely to destroy or adversely modify the listed species' critical habitat. NMFS must determine whether habitat modifications appreciably diminish the value of critical habitat for both survival and recovery of listed species. NMFS identifies those effects of the action that impair the function of any essential habitat element of critical habitat. NMFS considers whether such impairment appreciably diminishes the habitat's value for the species' survival and recovery. If NMFS concludes that the action will jeopardize the species or adversely modify or destroy critical habitat it must identify any reasonable and prudent alternatives available.

NMFS reviewed the status of Puget Sound chinook, the environmental baseline for the action area, the direct, indirect, and cumulative effects of the proposed action. By itself, the proposed pier extension will reduce the function of habitat indicators that are presently functioning at-risk in the immediate area of this part of the action. Furthermore, the proposed pier extensions will slow (but not prevent) the ability of not properly functioning habitat indicators to improve toward properly functioning condition. Nearshore habitat in the head of Commencement Bay is limited and what remains is mostly degraded. However, with the minimization measures incorporated, the action's adverse effects are offset to the extent that, by itself, the proposed action will not prevent eventual attainment of PFCs. Based on the forgoing, it is NMFS' biological opinion that the action is not likely to jeopardize the continued existence of Puget Sound chinook and will not result in the destruction or adverse modification of

designated critical habitat for these listed salmon. The determination of non-jeopardy was based on the current status of the Puget Sound chinook salmon, the environmental baseline for the proposed action area, and the adverse and beneficial effects of the proposed action.

NMFS finds that any negative effects associated with the actual construction activities may be minimized or eliminated through the adherence to the project design objectives, and adherence to the WDFW recommended timing of construction (HPA issued 19 December 2000).

VII. REINITIATION OF CONSULTATION

Consultation must be reinitiated if: the amount or extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; new information reveals effects of the action that may affect listed species in a way not previously considered; the action is modified in a way that causes an effect on listed species that was not previously considered; or, a new species is listed or critical habitat is designated that may be affected by the action (50 CFR § 402.16).

In addition, specific to the proposed project, reinitiation is required if any mitigation goals described in Section 4.2 of the Maersk Sealand Pier Extension Project Mitigation Plan (December 2000) are not met, and/or, if after the year three monitoring, performance standards have not been met. Reinitiation will be necessary if the 2 ½ inch minus rock material placed under the pier is not providing benefit to juvenile chinook salmon. Finally, reinitiation will be necessary if monitoring shows that the expanded Gog-Li-Hi-Te wetland is not providing additional area of properly functioning rearing opportunities for juvenile chinook salmon.

VIII. INCIDENTAL TAKE STATEMENT

Sections 4 (d) and 9 of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, spawning, rearing, migrating, feeding, and sheltering (50 C.F.R. 222. 102). Harass is defined as actions that create the likelihood of injuring listed species to such an extent as significantly alter normal behavior patterns that include, but are not limited to, breeding, feeding and sheltering. Incidental take is take of listed animal species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary; in order for the exemption in section 7(o)(2) to apply, they must be implemented by the action agency so that they become binding conditions of any

grant or permit issued to the applicant as appropriate. The ACOE has a continuing duty to regulate the activity covered in this incidental take statement. If the ACOE fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. The take statement also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

A. Amount or Extent of Take

NMFS has developed the following incidental take statement based on the premise that all minimization measures described will be fully implemented. Without these measures, the proposed action would likely result in destruction or adverse modification of designated critical habitat.

NMFS expects an undetermined number of Puget Sound chinook salmon may be taken as a result of full implementation of the proposed action, including the implementation of the minimization measures described. However, the actual number of individual fish taken as a result of the entire project is not possible to determine. While direct injury or death may unintentionally result during construction activities and biological monitoring, harm is more likely to accrue by exposure of fish to further degradation of the nearshore environment during juvenile rearing and migration. The timing, duration, and extent of such exposure will vary during the course of implementing proposed project activities. The qualitative results of such effects can be described in this opinion, but no techniques presently exist to correlate those effects with the potential numerical extent of take. The project will incrementally limit the carrying capacity of the Puyallup River estuary. For the purposes of this opinion, the extent of take is correlated to the extent of habitat affected and the number of individuals captured during biological monitoring of the beach creation, and at the substrate enhancement sites. Accordingly, the reasonable and prudent measures were developed to address the extent of habitat effects and sampling effects, as described below.

The incidental take of this species is expected to be in the form of harm, harassment, kill and injury, resulting from activities covered under this biological opinion. Incidental take may occur through short-term and long-term exposure of juvenile Puget Sound chinook to multiple stresses from elevated turbidity, contaminants released in the water column, increased predation, and loss of opportunity to utilize a segment of shoreline and associated prey base (affecting both growth and survival of chinook). These multiple stressors may pose long-term population impacts such as the increase in mortality from predation and/or disease through reductions in growth rates, multiple generational impacts, reduction in vigor, and long-term fecundity. In the accompanying biological opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat. However, while the exact effects are not measurable, there will be a reduction in the already degraded environmental baseline for juvenile chinook salmon nearshore rearing habitat. Reasonable and prudent measures have been developed to address and minimize the extent of affected habitat.

B. Reasonable and Prudent Measures

NMFS finds that the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of Puget Sound chinook.

1. The Port of Tacoma will minimize take by avoiding or minimizing adverse effects to threatened juvenile Puget Sound chinook refuge and foraging habitat, and migration behaviors.
2. The Port of Tacoma will minimize take by developing information to inform decisions for minimizing incidental take of Puget Sound chinook from activities associated with the increased berth capacity created by the proposed action.

C. Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the parties must comply with the following terms and condition, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary. The ACOE should include these terms and conditions as permit requirements under the federal permit issued by the ACOE under Section 10 of the Rivers and Harbor Act and Section 404 of the Clean Water Act.

1. To implement reasonable and prudent measure 1:
 - a. The Port of Tacoma shall conduct fish surveys at the proposed intertidal beach in the Hylebos Waterway (to identify migration and rearing) to apply to years 1, 3 and 8 subsequent to the completion of construction. Five surveys shall be conducted at the created beach, and at a suitable reference beach, using a 30 meter beach seine between julian days 51-60; 100-120; 140-160; 180-200; and 210-225 in each of these years. The Port of Tacoma should provide the sampling schedules to NMFS prior to the first fish survey of the year.
 - b. Minimize direct take of salmon during sampling by: ensuring that sufficient qualified technicians are on-site to quickly process each net sample; minimizing the time that the fish are entangled in the net; placing each fish in a container of water immediately after removal from net; measuring fork-lengths while fish are immersed in water; releasing all fish immediately after processing; and observing behavior of fish after release to confirm live release.
 - c. Sampling of epibenthic invertebrates shall coincide with fish surveys conducted between julian days 100-120; 140-165; 180-200; and 210-225 in each sampling year.

- d. To minimize take of listed Puget Sound chinook salmon juveniles, pile driving and other in-water work, including construction of the mitigation sites, shall not occur from March 1 to July 15 of any year.
- e. Monitor the expanded Gog-Le-Hi-Te wetland to assess physical conditions and range of ecological functions provided to juvenile chinook (as per February 16, 2001 conceptual plan).
- f. Adhere to the provisions of the WDFW Hydraulic Project Approval as issued December 19, 2000, and the Washington Department of Ecology's Water Quality Certification as issued on December 22, 2000.
- g. Design the night pier-lighting system to minimize the illumination of the water surface. Light levels at the water surface should be below 13 lux.
- h. The Port shall monitor and maintain the 2 ½ inch minus material until such time when the pier is removed. If the rock substrate washes away over time, the Port shall employ either of the following options:
 - i. re-nourish with the same type of material to achieve an average 6 inch depth;
 - ii. use a different type (approved by NMFS) of gravel mix;
 - iii. discuss with NMFS other enhancement options.

2. To implement reasonable and prudent measure 2:

- a. The Port shall develop and conduct a three-year monitoring plan in cooperation with Washington Department of Ecology to determine the efficacy of the management practices used to reduce storm water sources of contamination. This monitoring plan should be completed by December 31, 2001 and provided to NMFS for review.
- b. The Port shall develop and implement a literature review and engineering assessment of the effects that propeller wash may have on habitat conditions within the Sitcum Waterway.

IX. CONSERVATION REQUIREMENTS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of listed species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat. The following are discretionary suggested actions that the ACOE can implement in furtherance of its responsibilities under section 7(a)(1) of the ESA.

1. Large industrial projects such as the one considered in this opinion are usually planned years in advance. To the extent the ACOE has knowledge of these projects, the ACOE should involve NMFS much earlier in the planning process to help identify minimization measures that can be incorporated early in, as opposed to during, the consultation process. As a means to increase the operational flexibility and regulatory certainty of the Port of Tacoma, the ACOE should encourage the Port to pursue long term conservation planning opportunities with the NMFS, through either section 4(d) and/or section 10 of the ESA.
2. The ACOE should recommend that the Port install adequate banks of high intensity full-spectrum lights on that portion beneath the new pier which would light the intertidal and shallow subtidal zone. This lighting would be for day time hours only and could improve the utility of the shoreline for juvenile chinook and other salmonids as a migration, feeding, rearing and refugia corridor.
3. The ACOE should stipulate that the Port of Tacoma encourage companies, whose ships call at the Port, to use antifouling paints which do not contain TBT.
4. In order to achieve the desired objective and to assure achievement of properly functioning condition, public access should be restricted around each of the intertidal habitat basins. The Port should commit to removal of garbage or other unnatural debris that may accumulate at these sites.
5. The Port of Tacoma should encourage the planting of upland native riparian vegetation around the intertidal habitat basin created in the Hylebos Waterway to provide bank stability, detritus, shade, and insects to support ecological functions contributing to rearing Puget Sound chinook salmon. Native riparian vegetation (woody and non-woody) should be planted on the upland bank of the intertidal habitat basin. This vegetation should be installed during late fall and within the first year following completion of all mitigation projects in the intertidal habitat basin. The intertidal habitat basin riparian vegetation should be monitored throughout the life of the pier extension project and plants maintained (without the use of pesticides) or replaced as necessary. Large trees existing on the site should be left per field visit between the Port and NMFS on December 7, 2000.
6. The Port should develop and implement a study that assesses the effects that propeller and bow thruster wash may have on habitat conditions within the Sitcum Waterway. The study should be based on the expected current velocity conditions generated by the actual ships which come in and out of the Maersk Sealand terminal, and investigate the extent of the affected area, the water quality conditions within the waterway during berthing and the effect on substrates and the benthic community within the affected area.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed Puget Sound chinook, or their habitats, NMFS requests notification of the implementation of the above conservation recommendations.

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X. ESSENTIAL FISH HABITAT

A. Background

The objective of the Essential Fish Habitat (EFH) consultation is to determine whether the proposed action may adversely affect designated EFH for relevant species, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse impacts to EFH resulting from the proposed action.

B. Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires the inclusion of EFH descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NMFS on activities that may adversely affect EFH.

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting the definition of essential fish habitat: waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50CFR600.110).

Section 305(b) of the MSA (16 U.S.C. 1855(b)) requires that:

- Federal agencies must consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH;
- NMFS shall provide conservation recommendations for any Federal or State activity that may adversely affect EFH;
- Federal agencies shall within 30 days after receiving conservation recommendations from NMFS provide a detailed response in writing to NMFS regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NMFS, the Federal agency shall explain its reasons for not following the recommendations.

The MSA requires consultation for all actions that may adversely affect EFH, and does not distinguish between actions within EFH and actions outside EFH. Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NMFS

is required by Federal agencies undertaking, permitting or funding activities that may adversely affect EFH, regardless of its location.

C. Identification of EFH

The Pacific Fisheries Management Council (PFMC) has designated EFH for federally-managed fisheries within the waters of Washington, Oregon, and California. The designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km)(PFMC 1998a, 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years)(PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border.

Detailed descriptions and identifications of EFH for the groundfish species are found in the Final Environmental Assessment/Regulatory Impact Review for Amendment 11 to The Pacific Coast Groundfish Management Plan (PFMC 1998a) and NMFS Essential Fish Habitat for West Coast Groundfish Appendix (Casillas *et al.* 1998). Detailed descriptions and identifications of EFH for the coastal pelagic species are found in Amendment 8 to the Coastal Pelagic Species Fishery Management Plan (PFMC 1998b). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the impacts to these species' EFH from the proposed action is based on this information.

D. Proposed Actions

The proposed actions are detailed above in Section I. The action area includes the adjacent uplands, intertidal and subtidal shoreline from the Gog-Le-Hi-Te wetland, just upstream of the Lincoln Avenue bridge, in the lower Puyallup River, north to Browns Point. This area encompasses the lower Puyallup River, all of the waterways north of the river, and the shoreline out to Browns Point. The project occurs within an area designated as EFH for various life stages of 47 species of groundfish, four species of coastal pelagics, and three species of Pacific salmon (Table 2).

E. Effects of Proposed Action

As described in detail in Section IV, the proposed activities may result in detrimental short- and long-term impacts to a variety of habitat parameters. These impacts include:

1. Approximately 2.5 acres of habitat, utilized by groundfish, coastal pelagic species, and Pacific salmon, will be lost due to shading by the pier, including 700 linear feet of shoreline. This area consists of 0.76 acres of intertidal and shallow subtidal habitat (to -10ft MLLW), and approximately 1.74 acres of deep subtidal habitat. The loss of salmonid habitat is being mitigated by construction of 0.39-1.0 acres of high marshland at the Gog-Li-Hi-Te wetlands and 0.38 acres of shallow tidelands on the Hylebos Waterway. These sites, however, do not fully mitigate the loss of habitat for the affected species. The Gog-Li-Hi-Te site is in a riverine environment that is not utilized by the non-salmonids, while the Hylebos site mitigates for only one-half of the shallow water habitat that will be lost, and none of the deep subtidal habitat. The net result is a loss of approximately 2.1 acres of habitat utilized by groundfish and coastal pelagics. This loss is especially important given the overall poor conditions of Commencement Bay.
2. Pile driving will have short-term impacts on sound levels in the project area. While little information is available on the effects of the sound generated by pile driving activity on fishes, Feist *et al.* (1992) demonstrated that such sounds can alter the behavior of juvenile salmonids. The effects on groundfishes, especially the early life history stages, may be more severe because they are often less mobile than the species studied by Feist *et al.*, and would be less able to avoid the construction area. In addition, those species closely associated with the bottom (e.g., flatfishes) may be exposed to greater disturbance.
3. During the construction phase, debris may enter the waterway.
4. Runoff of untreated stormwater into the waterway poses a long-term risk of contamination of the water and sediments from oil, grease, and heavy metals. This is especially important for species that will utilize the area on a long-term basis, such as flatfishes and rockfishes.
5. Construction of the pier will result in a small loss of riparian vegetation and elimination of the potential for any long-term riparian establishment. Detritus contributed by such vegetation is an important component of the nearshore food web. This may have a long-term, adverse impact on the abundance of prey organisms in the action area. Due to the present conditions in Commencement Bay, the loss of this vegetation is important.
6. Lights located on the pier may illuminate the surface of the water. Such illumination, if sufficiently intense, is known to attract the larvae and juveniles of many species of fishes, as well as their predators. This may have a long-term, adverse impact on EFH.
7. The removal of the existing dolphins, and the driving of new piles may result in short-term increases in suspended sediments and turbidity. Sufficiently high levels of suspended sediments are known to alter behavior (Johnson and Wildish, 1981) and clog the gills of fish, causing asphyxiation (Sherk *et al.* 1974).

8. The use of TBT as an antifouling agent on ships that call at the facility may result in chronic contamination. Accumulation of TBT in the sediments may have a long-term, adverse impact on the benthic community and the prey species upon which the EFH-species depend. This is especially important for species that will utilize the area on a long-term basis, such as the flatfishes and rockfishes.
9. The use of herbicides and pesticides to maintain vegetation at the project site poses a long-term risk of contamination of the water and substrate. This is especially important for species that will utilize the area on a long-term basis, such as the flatfishes and rockfishes.

F. Conclusion

NMFS believes that the proposed action may adversely impact the EFH for the groundfish, coastal pelagic, and Pacific salmon species listed in Table 2.

Table 2. Species of fishes with designated EFH in Puget Sound.

Groundfish Species	redstripe rockfish <i>S. proriger</i>	curlfin sole <i>Pleuronichthys decurrens</i>
spiny dogfish <i>Squalus acanthias</i>	rosethorn rockfish <i>S. helvomaculatus</i>	Dover sole <i>Microstomus pacificus</i>
big skate <i>Raja binoculata</i>	rosy rockfish <i>S. rosaceus</i>	English sole <i>Parophrys vetulus</i>
California skate <i>Raja inornata</i>	rougeye rockfish <i>S. aleutianus</i>	flathead sole <i>Hippoglossoides elassodon</i>
longnose skate <i>Raja rhina</i>	sharpchin rockfish <i>S. zacentrus</i>	petrale sole <i>Eopsetta jordani</i>
ratfish <i>Hydrolagus coliei</i>	splitnose rockfish <i>S. diploproa</i>	rex sole <i>Glyptocephalus zachirus</i>
Pacific cod <i>Gadus macrocephalus</i>	striptail rockfish <i>S. saxicola</i>	rock sole <i>Lepidopsetta bilineata</i>
hake <i>Merluccius productus</i>	tiger rockfish <i>S. nigrocinctus</i>	sand sole <i>Psettichthys melanostictus</i>
black rockfish <i>Sebastes melanops</i>	vermillion rockfish <i>S. miniatus</i>	starry flounder <i>Platichthys stellatus</i>
bocaccio <i>S. paucispinis</i>	yelloweye rockfish <i>S. ruberrimus</i>	arrowtooth flounder <i>Atheresthes stomias</i>
brown rockfish <i>S. auriculatus</i>	yellowtail rockfish <i>S. flavidus</i>	Coastal Pelagic Species
canary rockfish <i>S. pinniger</i>	shortspine thornyhead <i>Sebastolobus alascanus</i>	anchovy <i>Engraulis mordax</i>
China rockfish <i>S. nebulosus</i>	cabezon <i>Scorpaenichthys marmoratus</i>	Pacific sardine <i>Sardinops sagax</i>
copper rockfish <i>S. caurinus</i>	lingcod <i>Ophiodon elongatus</i>	Pacific mackerel <i>Scomber japonicus</i>
darkblotch rockfish <i>S. crameri</i>	kelp greenling <i>Hexagrammos decagrammus</i>	market squid <i>Loligo opalescens</i>
greenstriped rockfish <i>S. elongatus</i>	sablefish <i>Anoplopoma fimbria</i>	Salmonid Species
Pacific ocean perch <i>S. alutus</i>	jack mackeral <i>Trachurus symmetricus</i>	chinook salmon <i>Oncorhynchus tshawytscha</i>
quillback rockfish <i>S. maliger</i>	Pacific sanddab <i>Citharichthys sordidus</i>	coho salmon <i>O. kisutch</i>
redbanded rockfish <i>S. babcocki</i>	butter sole <i>Isopsetta isolepis</i>	Puget Sound pink salmon <i>O. gorbuscha</i>

G. EFH Conservation Recommendations

The conservation measures that the COE has built into the project are generally applicable to EFH for the species listed in Table 2 and are intended minimize the potential adverse impacts to EFH.

However, these measures do not address the potential impacts described above. Due to these potential impacts to EFH, NMFS has the following conservation recommendations:

1. Adopt Conservation Recommendation #1, as described in Section IX to address EFH effect #1. This action could improve the utility of this area to fishes for feeding, rearing, refuge, and as a migration corridor, thereby reducing EFH impact #1.
2. Pier-construction projects in the future should incorporate design and operational measures which allow natural illumination of the under-pier area. Such measures would increase primary and secondary productivity, enriching the prey base, and would allow for increased utilization of the area by fishes for feeding, rearing, refuge, and as a migration corridor. Such an action would minimize EFH impact #1.
3. Adopt Terms and Conditions 1g-2b, as described in Section VIII, to minimize EFH impacts #2 thru #4.
4. Adopt Conservation Recommendation #5 as described in Section IX to minimize EFH impact #5.
5. Collect and treat stormwater runoff from the pier to remove potential contaminants prior to discharging it into the waterway and minimize EFH impact #6.
6. Use a turbidity curtain to contain suspended sediments during pile removal and pile driving. This will reduce the potential for deleterious increases in turbidity in the project area, thereby minimizing EFH impact #7.
7. Adopt Conservation Recommendation # 3, as described in Section IX to minimize EFH impact #8. This will reduce the potential for the long-term, chronic contamination of the water and sediments.
8. Eliminate the use of fertilizers, herbicides and pesticides in the maintenance of vegetation at the project site. If used, chose fertilizers, herbicides and pesticides that have the least impact on the aquatic environment and use the minimal amount necessary to accomplish the desired effect. This will reduce the potential for long-term contamination of the water and sediments and thereby minimize EFH impact #9.

H. Statutory Response Requirement

Please note that the Magnuson-Stevens Act (§305(b)) requires the Federal agency to provide a written

response to NMFS' EFH conservation recommendations within 30 days of its receipt of this letter. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity. If the response is inconsistent with NMFS' conservation recommendations, the reasons for not implementing them must be included.

I. Consultation Renewal

The Corps must reinitiate EFH consultation with NMFS if either action is substantially revised or new information becomes available that affects the basis for NMFS' EFH conservation recommendations (50 CFR 600.920).

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